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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MIN-CHUL SAN, JA-HUM KU, CHUL-SUNG KIM,
KWAN-JONG ROH, and MIN-JOO KIM

Appeal 2009-012050
Application 10/621,292
Technology Center 2800

Before JOSEPH F. RUGGIERO, MAHSHID D. SAADAT,
and ELENI MANTIS MERCADER, *Administrative Patent Judges*.

MANTIS MERCADER, *Administrative Patent Judge*.

DECISION ON APPEAL¹

¹ The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, or for filing a request for rehearing, as recited in 37 C.F.R. § 41.52, begins to run from the “MAIL DATE” (paper delivery mode) or the “NOTIFICATION DATE” (electronic delivery mode) shown on the PTOL-90A cover letter attached to this decision.

STATEMENT OF THE CASE

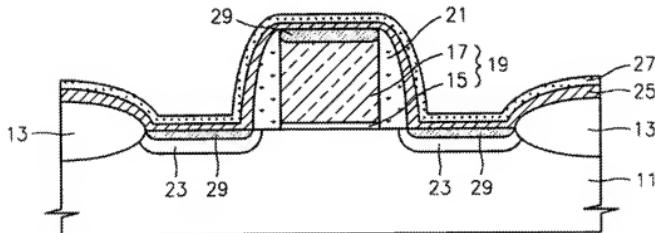
Appellants appeal under 35 U.S.C. § 134(a) from the final rejection of claims 1, 2, 5-8, 12, 13, 16-19, 22, 23, and 26-31. We have jurisdiction under 35 U.S.C. § 6(b).

We reverse.

INVENTION

Appellants' Figure 2C is reproduced below:

FIG. 2C



As depicted in Appellants' Figure 2C, the claimed invention is directed to a nickel alloy self aligned silicide (salicide) process for a semiconductor device (Spec. 3:9-11). The invention solves the problems of a Co silicide process of shorting and lumping of cobalt silicide by using a Ni-alloy silicide process with an N-rich titanium nitride layer 27 (Spec. 1:24-2:6; 2:25-3:4; 5:14-16; Fig. 2C). The process forms a gate 19 and source/drain regions 23, a Ni-based metal layer 25 comprised of the nickel

alloy, and an N-rich titanium nitride layer 27 thereover. Then the process anneals the structure to form silicide 29 on the gate and source/drain regions. See Figs. 2B-2D, 3; Spec. 4:5-7:2.

Claim 1, reproduced below, is representative of the subject matter on appeal (emphases added):

1. A method for fabricating a semiconductor device comprising:
forming a gate pattern and a source/drain region on a silicon substrate;
forming a Ni-based metal layer comprised of a nickel alloy for silicide on the silicon substrate where the gate pattern and the source/drain region are formed;
forming an N-rich titanium nitride layer on the Ni-based metal layer comprised of the nickel alloy for silicide;
thermally treating the Ni-based metal layer comprised of the nickel alloy for silicide and the N-rich titanium nitride layer to form a nickel silicide layer on each of the gate pattern and the source/drain region; and
selectively removing the Ni-based metal layer comprised of the nickel alloy for silicide and the N-rich titanium nitride layer to expose a top portion of the nickel silicide on the gate pattern and the source/drain region,
whereby the nickel silicide on the gate pattern is neither shorted nor cut, and lumping of the nickel silicide is prevented, and *wherein the Ni-based metal layer comprised of the nickel alloy for silicide is a nickel alloy layer including greater than 0 to about 20 % of a material selected from the group consisting essentially of Ta, Zr, Ti, Hf, W, Pt, Pd, V, Nb, or any combination thereof.*

THE REJECTIONS

The Examiner relies upon the following as evidence of unpatentability:

Doan	US 5,196,360	Mar. 23, 1993
Takeuchi	US 5,766,997	Jun. 16, 1998
Maex	US 2002/0151170 A1	Oct. 17, 2002
Catabay	US 6,503,840 B2	Jan. 7, 2003

Jaiswal	US 6,664,166 B1	Dec. 16, 2003
Hill	US 6,775,046 B2	Aug. 10, 2004

The following rejections are before us for review:

1. The Examiner rejected claims 1, 5, 6, 12, 16, 17, 27, 28, and 31 under 35 U.S.C. § 103(a) as being unpatentable over Doan in view of Takeuchi and Maex.
2. The Examiner rejected claims 2, 7, 8, 13, 18, 19, 22, 23, 26, 29, and 30 under 35 U.S.C. § 103(a) as being unpatentable over the combination of Doan with Takeuchi and Maex as applied to claims 1, 5, 6, 12, 16, 17, 27, 28, and 31 above, and further in view of Catabay, Jaiswal, and Hill.

ISSUE

The pivotal issue is whether the Examiner erred by finding that Maex renders obvious the limitation of “the Ni-based metal layer comprised of the nickel alloy for silicide is a nickel alloy layer including greater than 0 to about 20 % of a material selected from the group consisting essentially of Ta, Zr, Ti, Hf, W, Pt, Pd, V, Nb, or any combination thereof” as recited in independent claim 1.

FINDING OF FACT

The following Finding of Fact is supported by a preponderance of the evidence:

The first layer structure can also include a cobalt-nickel alloy with the nickel content varying from 0 to 100%; preferably the nickel content of the alloy is smaller than 50%, more preferably smaller than 25%, more preferably less than 15%, and can even be less than [sic] 10%. Also, other metals such as Pt or Pd can be chosen as elements that are present in the first layer

structure. . . . Also, other elements such as Au, Ir, Os, Rh, Ti, Ta, W, Mo, Cr, C, and Ge can be part of the first layer structure. (Maex ¶ [0014]).

PRINCIPLE OF LAW

The Examiner's articulated reasoning in the rejection must possess a rational underpinning to support the legal conclusion of obviousness. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). The Supreme Court stated that “[r]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (quoting *Kahn*, 441 F.3d at 988).

ANALYSIS

Appellants argue (App. Br. 11-12; Reply Br. 11-13) that Maex’s teaching of 0 to 100% concentration of Ni and other chosen elements Pt, Pd, Au, Ir, Os, Rh, Ti, Ta, W, Mo, Cr, C, and Ge (*see FF*) provides insufficient motivation and guidance to form the “nickel alloy layer including greater than 0 to about 20 % of a material selected from the group consisting essentially of Ta, Zr, Ti, Hf, W, Pt, Pd, V, Nb, or any combination thereof” as recited in claim 1.

The Examiner finds (Corrected Ans. 6) that the “choice of ratio of elements in the Ni-based metal layer would have been a matter of routine optimization because elements ratio, amongst many other variable parameters, is known to affect device properties and would depend on the desired device density on the finished wafer and the desired device

characteristics.” Also, the Examiner reasons (Corrected Ans. 6) that one of ordinary skill in the art would have been led to the claimed 0 to 20% of the chosen elements in the alloy through routine experimentation to achieve the desired characteristics as suggest by Maex.

We agree with Appellants that the claimed ranges are non-obvious because the Examiner has not articulated reasoning that provides a rational underpinning to support the legal conclusion of obviousness. *See KSR*, 550 U.S. at 418. This is because Maex’s teaching of 0 to 100% concentrations of Ni and other chosen elements gives insufficient basis to achieve the claimed “*nickel alloy layer including greater than 0 to about 20 % of a material selected from the group consisting essentially of Ta, Zr, Ti, Hf, W, Pt, Pd, V, Nb, or any combination thereof*” (emphasis added).

Thus, we will not sustain the Examiner’s rejection of claim 1 and for similar reasons the rejections of claims 5, 6, 12, 16, 17, 27, 28, and 31. Likewise, we will not sustain the Examiner’s rejection of claims 2, 7, 8, 13, 18, 19, 22, 23, 26, 29, and 30 because the additional references of Catabay, Jaiswal, and Hill do not cure the above cited deficiency.

CONCLUSION

Appellants have shown that the Examiner erred in finding that Maex renders obvious the limitation of “the Ni-based metal layer comprised of the nickel alloy for silicide is a *nickel alloy layer including greater than 0 to about 20 % of a material selected from the group consisting essentially of Ta, Zr, Ti, Hf, W, Pt, Pd, V, Nb, or any combination thereof*” as recited in claim 1 (emphases added).

Appeal 2009-012050
Application 10/621,292

ORDER

The decision of the Examiner to reject claims 1, 2, 5-8, 12, 13, 16-19, 22, 23, and 26-31 is reversed.

REVERSED

babc

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